Tropical Storms and Hurricanes

Tropical Storms and Hurricanes:

- Bring heavy rains and wind speeds of between 39 and 73 mph; they reach hurricane status if wind speeds exceed 74 mph.
- Increase the mortality rate of trees to 40% in highly impacted areas, versus the 2% to 5% of rainforest trees that die of natural causes in normal years.
- Destroy habitats, especially microhabitats, causing species to die or move away.
- Sometimes bring permanent loss of habitat and species, depending on the severity of the storm and the extent of damage.
- Hurricanes increase the number of severely damaged trees, but the resulting breaks in the canopy allow light to reach the forest floor and can increase the growth of remaining plants.

Case Study: El Yunque National Forest, Puerto Rico

- Is a 28,000-acre tropical rainforest in the Sierra de Luquillo Mountains in eastern Puerto Rico.
- Was designated a Biosphere Reserve in 1976.
- Is home to endangered and endemic species: over 225 species of plants (23 are endemic); over 70 species of birds; diverse reptiles, amphibians, and invertebrates. Historically there were 22 mammal species here, but now the only mammals are bats (of 11 varieties).
- In 1989, Hurricane Hugo crossed eastern Puerto Rico and caused severe damage to the El Yunque rainforest; meteorologists estimate that storms of Hurricane Hugo's magnitude pass over this part of the El Yunque rainforest an average of once every 50 to 60 years.

Recovery

- The length of recovery depends on the severity of the storm. Scientists believe that full recovery from Hurricane Hugo damage could take at least 250 years.

El Yunque National Forest

Drought

Case Study: Lowland Tropical Rainforests of Borneo

- Borneo is third-largest island in the world; was once covered with dense rainforests.
- The island is part of three countries: Malaysia, Indonesia, and Brunei.
- The Malaysian part of Borneo includes the states of Sabah and Sarawak.
- The Indonesian part of Borneo includes the states of West Kalimantan, Central Kalimantan, South Kalimantan, and East Kalimantan.
- Brunei is an independent nation that includes the rest of the island.
- Borneo is home to 15,000 plant species (240 different species of trees can grow in one hectare there); 222 mammal species (including orangutans); over 350 species of birds; and many reptiles, amphibians, and freshwater fish.
- Many species there have overlapping ranges.

Drought:

- Occurs over long periods (months or years) when a region receives less water than normal.
- Results from a reduction in either rainfall or water vapor (rainfall is related to water vapor in the atmosphere).
- Weakens natural systems, making them more susceptible to fire.
- Weakens the forest canopy and affects leaf litter decomposition, which is essential to nutrient cycling and plant growth.
- Changes microclimates and affects microhabitats.
- Brings a decrease in the number and diversity of plant and animal species.

Drought, Fire, and El Niño

- El Niño, a major warming of equatorial waters in the Pacific Ocean, occurs every three to five years. In some regions it causes wetter conditions and in others, drought conditions.
- During El Niño years, rainforests are more susceptible to large fires, which can have negative, long-term effects on forest composition, structure, regeneration, and recovery.
- Fires can occur naturally and serve an important function in maintaining the health of certain ecosystems.
- Fires in rainforests are relatively rare where human activity is very limited.
- In forests affected by fire, ground vegetation can burn and clear the forest floor, which can promote growth of new plants.
- Between 1997 and 1998, millions of hectares of rainforest were destroyed around the world during an intense El Niño-related drought; the drought affected rainforests in Brazil, cloud forests in Chiapas, Mexico, and lowland rainforests in Borneo.

Recovery

- The length of time required for recovery from drought depends on the intensity of the drought, its duration, and the quantity of precipitation the area receives as the drought ends.

Lowland Tropical Rainforest of Borneo

Logging

Different Types of Logging

Logging by Clear-Cutting

- Results in the removal of all species of trees from a given area.
- Is often the chosen approach because in rainforests, no one species dominates the ecosystem, and valuable timber trees are widely spaced.
- Is a practice that requires road construction and often results in the settlement of an area by humans, in turn encouraging other human practices and activities.
- Results in the elimination of wildlife species due to loss of habitat.

Selective Logging

- Involves the felling of specific trees of significant value.
- During this process, only selected trees are cut, but the method also brings down other trees, vines, and epiphytes.
- Opens the canopy, which can take hundreds of years to recover.
- Affects decomposition of leaf litter and nutrient cycling.
- Requires road construction, a destructive activity, for transportation of timber.
- Disturbs soil and causes erosion.
- Results in the runoff of forest soils into rivers and streams and causes siltation.
- Leaves behind remnants of trees and underbrush (called “slash”), which are dry and susceptible to burning.
- Has indirect effects, such as stress to and loss of habitats, territory, shelter, and food for wildlife.

Byproducts from Deforestation of Rainforest Lands

- Soil erosion and chemicals in soil, water, and air.
- Loss of habitat.
- Loss of species.

Recovery

- A logged ecosystem never returns to its original condition; a recovered forest is not diverse.
- Little, if any, industrial logging is sustainable over time, whether clear-cutting or selective logging practices are used.
- Recovered forest could be used to grow sustainable forestry products and for low-intensity logging and agriculture.
- Restoration of some native species is possible; this process is most successful where remnants of original forest remain and there are few human pressures.

Logging

Farming

Case Study: Lowland Tropical Rainforests of Borneo

- Oil palms produce more oil per hectare than any other oilseed.
- Over 7 million hectares of Borneo rainforest are projected to be converted to oil palm plantations by 2011.

Farming

- Brings the clearing of both undisturbed and logged rainforest for crops and grazing.
- Often follows logging, which requires that roads to an area be built for transportation of timber (the roads open the new areas to agriculture).
- Consists of either commercial agriculture, subsistence farming, or shift cultivation.

Different Types of Farming

Commercial Agriculture

- Often occurs after large areas are clear-cut and then burnt to clear brush and release nutrients into the soil.
- Often uses chemicals for fertilization and pest control. The chemicals directly affect soil, water, and air quality.
- Indirectly causes stress and loss of habitats and food for wildlife.

Subsistence Farming

- Involves the cultivation of a small piece of land by a farmer to regularly produce enough crops for his or her family's survival.
- Involves the growth of a diversity of crops, a practice that does not deplete soil as readily as the growth of a single crop.
- Sometimes involves the use of the "slash-and-burn" technique to clear small areas.

Shift Cultivation

- Involves setting up small-scale farming operations in disturbed areas following roads made for logging and mining. After the lands become infertile, the farmers move on to new areas.
- People do not move into undisturbed rainforest; rather, they follow other developments like roads and mines.
- Results in nutrient-poor soils.
- Farmers may use chemical fertilizers to improve crop yield.

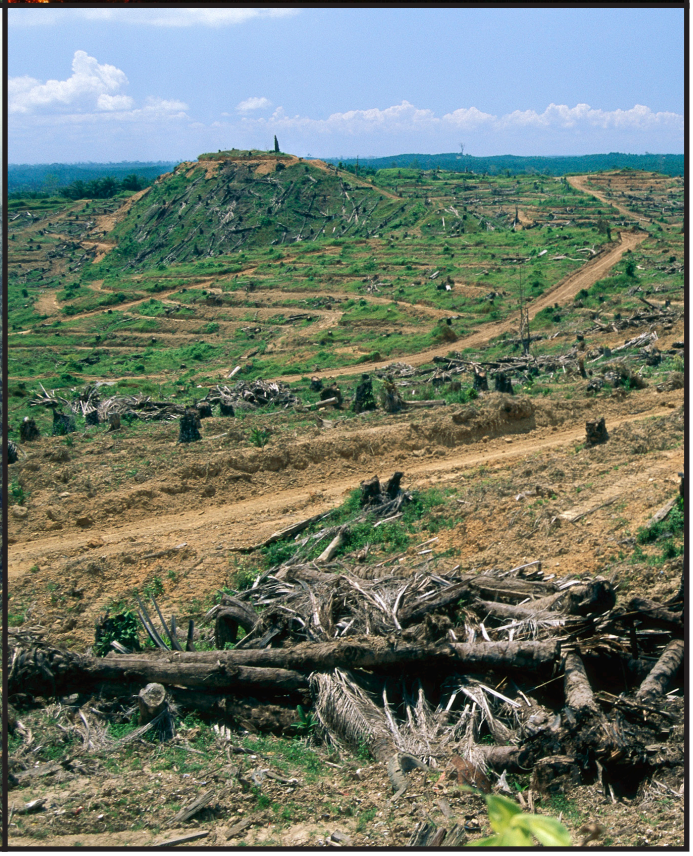
Byproducts from Agricultural Uses of Rainforest Lands

- Soil erosion.
- Introduction of chemicals into soil, water, and air.
- Loss of habitat.
- Loss of species.

Recovery

- Habitat destruction permanently reduces local geographic extent of rainforest species.
- The ecosystem never recovers to its original condition.
- Sustainable commercial agriculture depends on management techniques, allowing soils to remain fallow for periods of time, and reducing the use of chemicals.

Farming



Mining

Different Types of Mining

Open Pit Mining

- In the 1970s, mining companies began moving into rainforests and developing large-scale mining operations for gold, diamonds, copper, and other minerals.
- Large open pit gold mines destroy large surface areas and remove minerals from the ground.
- Miners use toxic chemicals, such as cyanide, to separate gold from ore.
- Tailings ponds created for iron ore waste contain cyanide that leaches into groundwater.
- Extraction processes require the clearing of forest for mines, access roads, and other mining operations.
- Requires heavy water consumption.
- Causes animal species to die or move away during mining, and plant life is destroyed.
- Pollutes air, land, and water.

Small-Scale Mining

- Almost all small-scale gold mining uses large, heavy equipment.
- Miners are not formally trained in mining techniques and have little oversight from the government.
- Small-scale gold mining uses mercury to separate gold from ore; mercury contaminates air, soil, and water and accumulates in fish.

Byproducts from Mining in the Rainforest

- Soil erosion.
- Chemicals that enter soil, water, and air.
- Loss of habitat.
- Loss of species.

Recovery

- Abandoned, small-scale gold mining sites can take several decades to recover due to disturbed soil and hydrology. Although these sites can recover somewhat, they never return to their original condition.

Mining